Appendix D

ON SHORE REMOTE SENSING INVESTIGATION: GEO-GRAF, INC.

GEO-GRAF

GEOPHYSICAL INVESTIGATIONS

GEOPHYSICAL INVESTIGATION REPORT
WOODLAND FERRY
NORTH & SOUTH LANDINGS
SEAFORD, DELAWARE
15 AUGUST 2007

Prepared for:

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Project Number: 080207

Project Summary:

This report contains the findings of a nonintrusive geophysical subsurface investigation performed by Geo-Graf, Inc. (GGI) on August 2, 2007, at the Woodland Ferry Nanticoke River Crossing, Woodland Ferry Road in Seaford, Delaware. The Investigation was conducted in accordance with the GGI Nonintrusive Geophysical Subsurface Investigation Proposal Number 2094, dated May 17, 2007.

The accessible sections of an approximately 3,500 ft^2 at the south landing and a 5,500 ft^2 at the north landing were investigated by GGI in an attempt to delineate subsurface anomalies that could be indicative of or associated with historic features related to ferry boat operations from the 18^{th} century to present.

South Landing

Subsurface anomalies were delineated that could represent an earlier road to the pier. Fill suspected to be associated within this earlier road was also detected. Based on the collected data, GGI was able to discern the former bulkhead/shoreline of an earlier construction of the landing.

One significant subsurface metallic anomaly was detected which could represent a construction feature, utility, or buried metallic debris.

North Landing

Subsurface anomalies were also delineated that could represent an earlier road to pier. An area containing shallow debris was detected within an undisturbed grassy section northeast of the pier.

A total of nine subsurface metallic anomalies were detected within the investigated area. GGI suspects these anomalies could be construction features or buried metallic debris.

Findings were incorporated by GGI into an existing CAD mapping file and are presented on a color plan-view Subsurface Anomaly Map (***SAM***) accompanying this report.

Scope of Work

Perform a nonintrusive geophysical subsurface investigation within the accessible sections of the specified search areas in an attempt to delineate subsurface anomalies that could be indicative of or associated with historic features related to ferry boat operations from the 18th century to present.

The nonintrusive geophysical delineation techniques utilized will include collection and interpretation of data from Ground Penetrating Radar (GPR), Electromagnetic (EM), Radio Frequency (RF) and Magnetic (MAG) instrumentation (where/when applicable). The collected site data will be analyzed and correlated with the findings presented on a color plan-view GGI Subsurface Anomaly Map (***SAM***).

Specified Search Area

Two areas of Woodland Ferry Road were specified for investigation. The accessible sections of an approximately 3,500 ft^2 area at the south landing pier were specified for investigation. The accessible section of an approximately 5,500 ft^2 area at the north landing pier were also specified for investigation.

Geophysical Investigation

On August 2, 2007, GGI performed a nonintrusive geophysical subsurface investigation as directed by Mr. William Liebeknecht, Principle Investigator – Hunter Research, Inc.

Investigative Procedure

To facilitate GPR data collection and documentation of site findings, GGI created a reference grid with 5′ intervals over the accessible sections of the specified search areas. The zero/zero reference datum points were located as indicated on the ***SAM***.

GGI initially investigated the accessible sections of the specified search area using EM and MAG in an attempt to locate subsurface metallic anomalies. Detected anomalies were field-marked in white paint and their locations documented by GGI.

GPR profiles were completed at 5′ intervals in both the north-south and east-west grid directions in an attempt to delineate subsurface metallic and nonmetallic anomalies. The GPR data was collected utilizing a 400 *MHz* antenna system. The GPR data profiles were recorded for subsequent review and post-processing at the GGI office. A total of 67 GPR data profiles were recorded for this project.

Geophysical Instrumentation

The following is a list and brief description of the geophysical instrumentation utilized for this investigation.

GPR

A Geophysical Survey Systems, Inc. Subsurface Interface Radar System 2000 GPR unit was used for this investigation. Profiles collected on site are digitally recorded for subsequent data analysis and post-processing at the GGI office.

Antenna Systems
Each GPR antenna operates at a different center band frequency that's measured in megahertz (*MHz*). The use of the different antenna systems is based on the fact that the higher the antenna frequency, the greater the GPR image resolution (ability to detect smaller-sized targets), but at the cost of signal penetration depth. Thus the converse is true, the lower the antenna frequency, the deeper the signal penetration, but at the cost of image resolution. For most projects the GGI field crew will carry five GPR antenna systems which range from 1500 *MHz* to 120 *MHz*. Additional antennas and configurations can be used for unique applications.

Data Interpretation
The GPR data profiles recorded at this site are downloaded from the collection unit for storage and analysis. Various computerized post-processing techniques are used in an attempt to improve the data resolution. Each profile is individually reviewed and the findings correlated with data from the other geophysical instruments used in this investigation. Profiles best representing the targets-of-concern are selected and annotated for inclusion in this report.

Applications
GPR data can be collected and used to delineate underground metallic and nonmetallic tanks, drums and utilities. The data can also be interpreted to delineate utility leaks, sinkholes and voids, geologic features such as near-surface consolidated rock and contamination plumes. GPR is the only nonintrusive technique capable of mapping burials within a cemetery. Other applications include the delineation of buried artifacts and historical structures, as well as, use in the structural engineering fields (concrete floor/wall analysis, post-tensioned cable locating).

EM
An Aqua-tronics Tracer, model A-6 was used for this investigation. EM techniques operate by inducing and measuring the returning electric field on subsurface metallic objects. Data is obtained in the field and can be recorded via a separate data collection unit.

Applications
EM techniques are utilized to delineate the location subsurface utilities as well as the location and boundaries of large buried metallic objects including tanks, drum piles and foundations among other things. EM is also capable of defining areas that contain conductive subsoil.

MAG
A Dunham and Morrow, model DML 2000 Magnetic Locator was used for this investigation. The instrument, also defined as a vertical-field gradiometer, operates by measuring the remnant vertical magnetic fields that naturally emanate from iron objects. Data is obtained in the field and can be recorded via a separate data collection unit.

Applications
MAG techniques are used to detect buried valve and manhole covers, individual drums or drum piles and assist in the detection of utilities, tanks and other anomalous features.

Findings

Refer to the color plan-view ***SAM*** for the plotted findings.

South Landing

Subsurface anomalies were delineated by GPR indicative of disturbed subsoil and anomalous subsoil layers.

Anomalous Subsoil Layer

GPR data signatures indicative of anomalous subsoil layers were delineated in an approximately 10′-wide stretch within the center of the existing road from the loading ramp to the landing gate. GPR-detected anomalous layer data signatures can be representative of subsoil containing excessive moisture, historic fill, and/or differing soil/fill compositions. In this case, GGI suspects that the anomalous layer is associated with the former road bed to the dock. Estimated depth to the top of the anomalous layer based on GPR data approximations is 1′ to 2′ below grade.

Disturbed Subsoil

Two approximately 20′-long areas of disturbed subsoil were delineated on both sides of the road closer to the pier. GPR-detected disturbed subsoil data signatures can be evidence of previous excavations and use of fill, or represent areas containing buried debris. In this case, GGI suspects the disturbed subsoil areas are associated with fill.

These disturbed subsoil areas are well-defined and do not seem to mimic current topography. Thus, GGI suggests that this fill is associated with an earlier era and is most likely related to the possible earlier road bed that was detected and described above. Estimated depth to the top of the disturbed subsoil interface is approximately 3′ to 4′ below grade.

In addition, two lines (as shown on the ***SAM***) were detected extending approximately 5′ to 10′ to both sides of the road. These lines symbolize the top of sloping data signatures which were interpreted by GGI to represent an earlier bulkhead or shoreline.

EM & Magnetic Anomalies

An EM and two magnetic subsurface metallic anomalies were detected and field-marked within the accessible sections of the investigated area. GPR data recorded over the EM anomaly indicated the presence of reinforcing within the concrete curbing.

The GPR data over the magnetic anomaly along the east side of the landing was indicative of a buried metallic target. GGI suspects this feature could be a construction feature, utility related, or isolated metallic debris.

North Landing

Subsurface anomalies were delineated by GPR indicative of disturbed subsoil and anomalous subsoil layers.

Anomalous Subsoil Layer

As on the south landing, GPR data signatures indicative of anomalous subsoil layers were delineated in an approximately 10′-wide stretch within the center of the existing road from the loading ramp to the intersection of Woodland Church Road. GPR-detected anomalous layer data

signatures can be representative of subsoil containing excessive moisture, historic fill, and/or differing soil/fill compositions. In this case, GGI suspects that the anomalous layer is associated with the former road bed to the dock. Estimated depth to the top of the anomalous layer based on GPR data approximations is 1′ to 2′ below grade.

Disturbed Subsoil

An area containing disturbed subsoil was delineated by GPR within a grassy area northeast of the pier. GPR-detected disturbed subsoil data signatures can be evidence of previous excavations and use of fill, or represent areas containing buried debris.

Unlike the south landing, GGI suspects the disturbed subsoil at the north landing represents areas containing buried debris. These disturbed subsoil signatures are shallower and appear to have no relation to earlier road/pier construction. Estimated depth to the top of the disturbed subsoil is approximately 0′ to 2′ below grade.

EM & Magnetic Anomalies

An EM and multiple magnetic subsurface metallic anomalies were detected and field-marked within the accessible sections of the investigated area.

GPR data recorded over the EM anomaly which was positioned near the area of GPR-detected disturbed subsoil was indicative of a shallow metallic target. This target was partially excavated by HRI at the time of the investigation to reveal what appeared to be a 55-gallon drum. The feature was otherwise undisturbed by HRI and the excavation was filled.

A magnetic anomaly positioned south of the aforementioned EM feature was also ground-truthed by HRI at the time of the investigation. The excavation revealed a metal cable possibly a remnant of the ferry's guide cable.

Based on these findings, GGI suspects that the other magnetic anomalies detected within this area are associated with construction features or isolated buried metallic debris.

Subsurface Utilities

Subsurface utilities were detected by GGI through the course of the geophysical investigation. GGI did not perform a utility investigation at this site. Additional utilities may exist within the search area and were neither detected nor field-marked.

The estimated maximum GPR signal penetration achieved at this site is approximately 5′ below grade. Thus, features existing at or below this depth will go undetected.

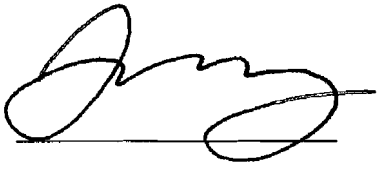
Recommendations

GGI did not perform a utility investigation at this site. Utilities may exist within the search areas and surrounding the detected anomalies. GGI strongly recommends that a utility investigation be performed in order to locate and field-mark underground utilities prior to any intrusive efforts.

GGI always recommends careful ground-truthing to verify all investigative findings. GGI recommended ground-truthing methods are hand-digging or *Soft-Dig* air/vacuum excavating.

All services provided by GGI are performed under the disclaimer found on the cover page of this report. Also note, just because features or anomalies were not detected by the geophysical techniques within the investigated area, does not preclude the possibility that they could exist and go undetected.

Respectfully submitted,



Jamieson Graf, President

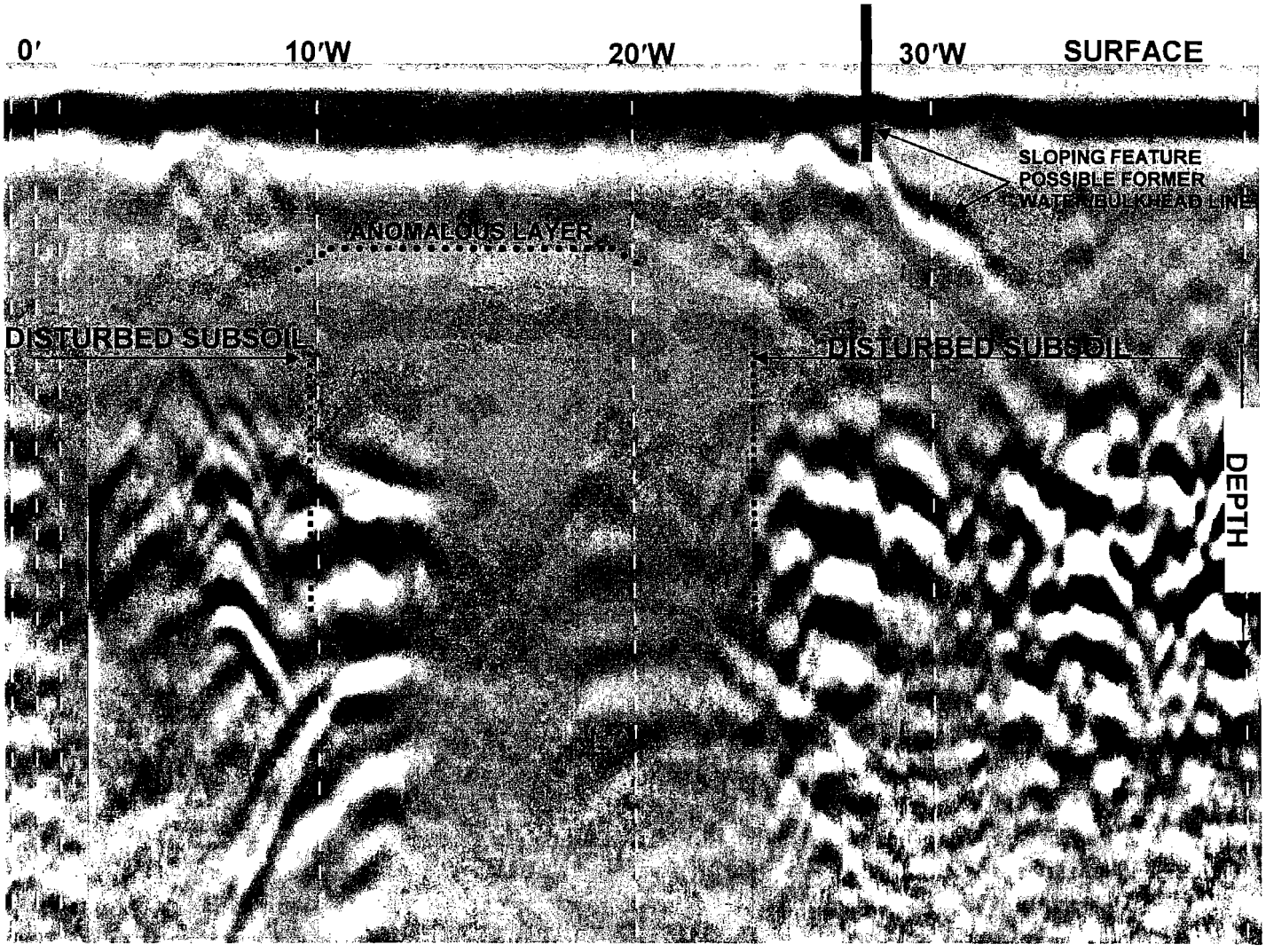


Figure 1-GPR Data Profile (South Landing)
Representative GPR data profile excerpt from the south landing pier. The profile is at 35'N extending from 0' to 40'W (GGI reference grid, refer to ***SAM***, sheet 1/2). Shown in this profile are the GPR data signatures indicative of an anomalous subsoil layer extending from approximately 10'W to 20'W. GGI suspects this layer could represent an earlier road. GPR data signatures indicative of disturbed subsoil are shown on either side of the anomalous layer. These signatures are expected to represent fill and are most likely of a similar era as the earlier road. Also shown is a sloping feature nearest the surface at 28'W which could be indicative of an earlier bulkhead or shoreline. Estimated depth of the features shown based on GPR data approximations is less than 4' below grade. 400 *MHz* GPR antenna system, edited from 50 *ns*.

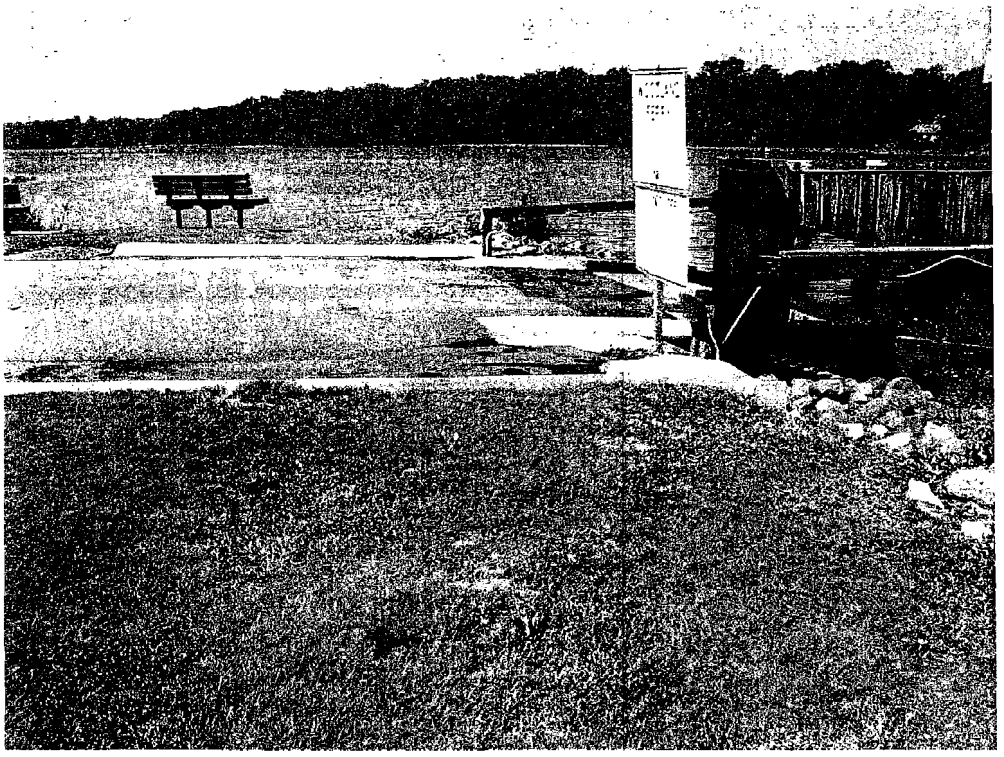


Figure 2 – Site Photograph – South Landing

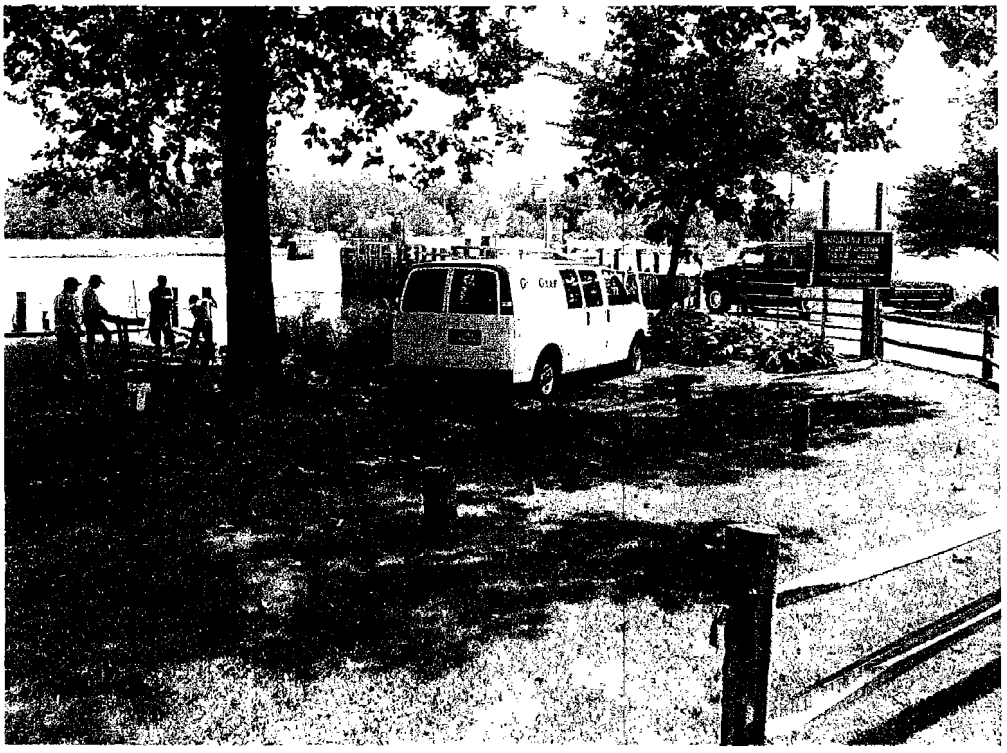
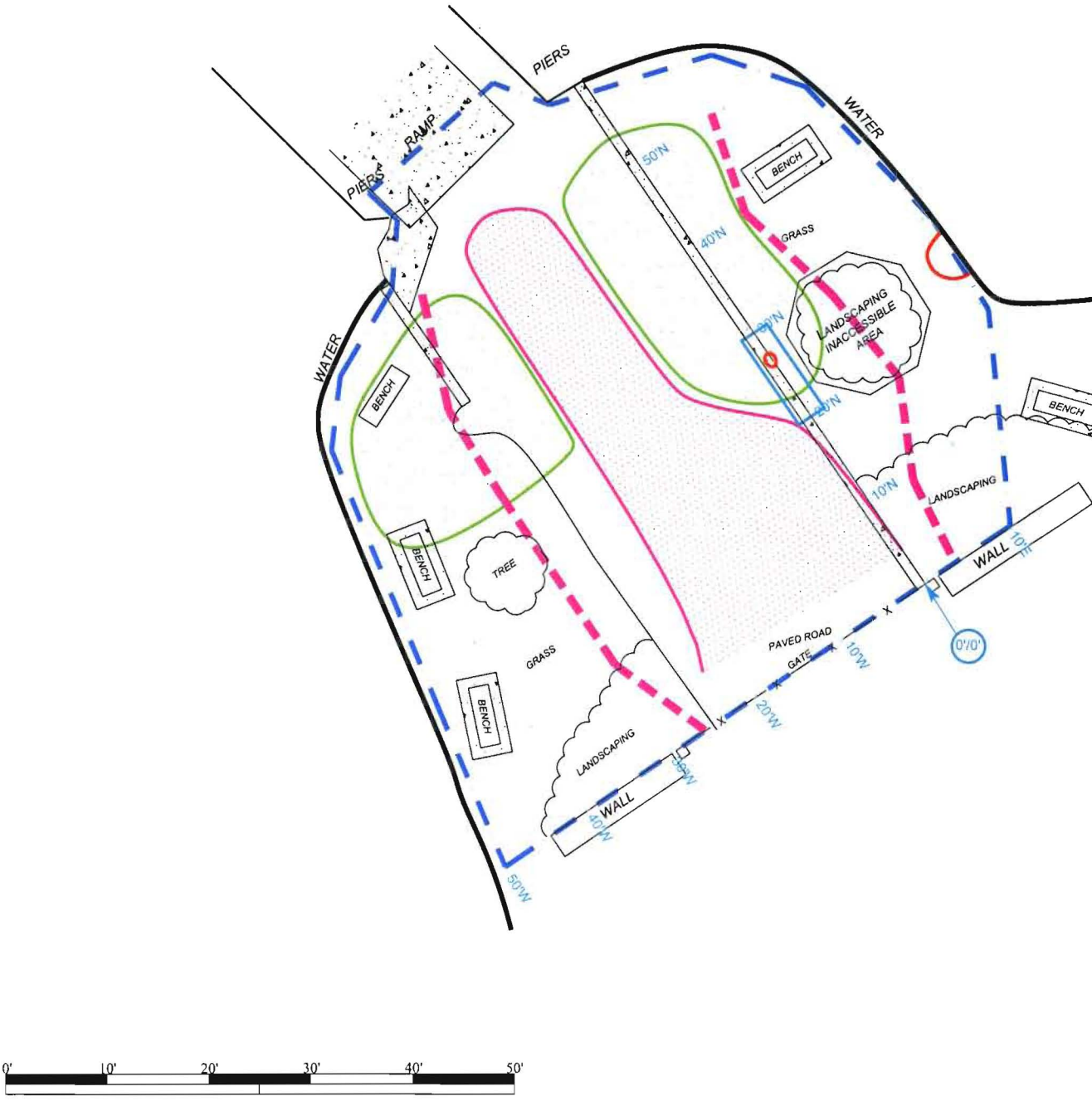


Figure 3 – Site Photograph – North Landing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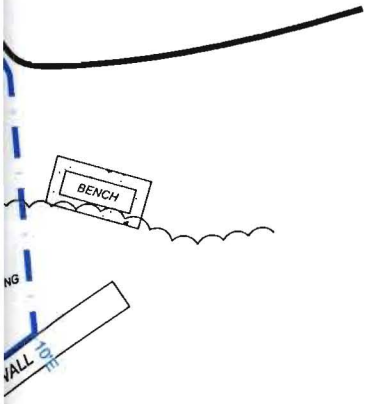

FINDING SUMMARY

GPR ANOMALIES
Subsurface anomalies delineated by GPR were categorized as follows:

Anomalous Subsoil Layer
GPR data signatures indicative of anomalous subsoil layers were delineated in an approximately 10'-wide stretch within the center of the existing road from the loading ramp to the landing gate. GPR-detected anomalous layer data signatures can be representative of subsoil containing excessive moisture, historic fill, and/or differing soil/fill compositions. In this case, GGI suspects that the anomalous layer is associated with the former road bed to the dock. Estimated depth to the top of the anomalous layer based on GPR data approximations is 1' to 2' below grade.

Disturbed Subsoil
Two approximately 20'-long areas of disturbed subsoil were delineated on both sides of the road closer to the pier. GPR-detected disturbed subsoil data signatures can be evidence of previous excavations and use of fill, or represent areas containing buried debris. In this case, GGI suspects the disturbed subsoil areas are associated with fill.

These disturbed subsoil areas are well-defined and do not seem to mimic current topography. Thus, GGI suggests that this fill is associated with an earlier era and is most likely related to the possible earlier road bed that was detected and described above. Estimated depth to the top of the disturbed subsoil interface is approximately 3' to 4' below grade.

In addition, two lines were detected extending approximately 5' to 10' to both sides of the road. These lines symbolize the top of sloping data signatures which were interpreted by GGI to represent an earlier bulkhead or shoreline.

EM ANOMALIES
EM-detected subsurface anomalies can represent buried metallic features such as tanks, drums, foundations (containing rebar), utilities, and/or metallic debris. EM anomalies can represent areas containing conductive subsoil.

MAG ANOMALIES
MAG-detected subsurface anomalies are representative of buried iron-containing features such as tanks, drums, foundations (containing rebar), metallic debris, certain utilities, buried valve, manhole, and/or well covers, etc.

SUBSURFACE UTILITIES
Subsurface utilities were detected by GGI through the course of the geophysical investigation. GGI did not perform a utility investigation at this site. Additional utilities may exist within the search area and were neither detected nor field-marked.

The estimated maximum GPR signal penetration achieved at this site is approximately 5' below grade. Thus, features existing at or below this depth will go undetected.

NOT A UTILITY MAP

GGI did not perform a utility investigation at this site. A utility investigation to locate and field-mark underground utilities prior to any intrusive efforts is strongly recommended.

The accessible sections of the search area, as shown, were investigated by Geo-Graf, Inc. (GGI) using Ground Penetrating Radar (GPR), Radio Frequency (RF), Electromagnetic (EM), and Magnetic (MAG) (where/when applicable) nonintrusive geophysical subsurface techniques in an attempt to delineate subsurface anomalies that could be indicative of or associated with historic features related to ferry boat operations from the 18th century to present.

Services and resulting interpretations provided by Geo-Graf, Inc., shall be performed with our best professional efforts. The depth of the GPR, EM, RF and/or magnetic signal penetration is dependent upon the electrical properties of the material probed. Thus, the resulting interpretations are opinions based on inference from acquired GPR, EM, RF, magnetic and/or other data. Geo-Graf, Inc., does not guarantee the desired signal penetration depth, accuracy or correctness of interpretations. Geo-Graf, Inc., will not accept liability or responsibility for any losses, damages or expenses that may be incurred or sustained by any services or interpretations performed by Geo-Graf, Inc., or others.

= GPR-DETECTED ANOMALY - SUBSURFACE LAYER
= GPR-DETECTED ANOMALY - DISTURBED SUBSOIL
= GPR-DETECTED ANOMALY - FORMER BULKHEAD/BANK
= EM-DETECTED SUBSURFACE ANOMALY
= MAG-DETECTED SUBSURFACE ANOMALY
= ELECTRIC CABLING
= GGI INVESTIGATED AREA
= GGI REFERENCE GRID
= AREA OF LIMITED ACCESSIBILITY

GGI recommends careful ground-truthing to verify and correlate all investigation findings. Recommended ground-truthing methods are hand digging or *Soft-Dig* (pot-holing) excavating.

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Specializing in Ground Penetrating Radar Investigations

SUBSURFACE ANOMALY MAP

GEOPHYSICAL INVESTIGATION FINDINGS
WOODLAND FERRY - **SOUTH LANDING**
SEAFORD, DELAWARE

PREPARED FOR:	SIZE	ORIGINAL MAPPING FILE PROVIDED BY HUNTER RESEARCH, INC.	GEO-GRAF, INC. PROJECT NUMBER:	REV
HUNTER RESEARCH, INC.	C		080207	A
DATE:	SCALE	FILE NAME:		DRAWN BY / SHEET
AUGUST 15, 2007	1" = 10'	080207-HUNTER.DWG		JG / 1/2